

**CARBON MEDIA FILTER ELEMENT**

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### BACKGROUND AND SUMMARY OF THE INVENTION

[0001] The invention relates to carbon media filter elements, including for  
5 meeting automotive evaporative emission requirements in induction systems.

[0002] Automotive manufacturers must meet ever decreasing evaporative  
emissions specifications for induction systems. It is known to incorporate a carbon  
media filter element in the engine intake system to meet the noted regulations. The  
carbon filter media is provided by a granular carbon layer sandwiched between first  
10 and second outer backing layers and formed in a pleated configuration. The ends of  
the pleats must be completely sealed to prevent escape of carbon granules out of  
such ends. Prior sealing techniques, such as hotmelt techniques, vibration welding,  
etc., have been found deficient in not providing sufficient structural integrity.

[0003] The present invention provides an improved sealing and support  
15 system.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0004] Fig. 1 is a perspective view of a carbon media filter element in  
accordance with the invention.

20 [0005] Fig. 2 is a perspective view from below of the element of Fig. 1.

[0006] Fig. 3 is an enlarged perspective view of a portion of Fig. 1, partially  
cut away.

[0007] Fig. 4 is a perspective view of a mold base for making the element of  
Fig. 1.

25 [0008] Fig. 5 is a perspective view of a mold top for making the element of  
Fig. 1.

[0009] Fig. 6 is a sectional view taken along line 6-6 of Fig. 4.

[00010] Fig. 7 is a sectional view taken along line 7-7 of Fig. 4.

[00011] Fig. 8 is a sectional view taken along line 8-8 of Fig. 1.

[00012] Fig. 9 is a sectional view taken along line 9-9 of Fig. 1.

#### DETAILED DESCRIPTION

[00013] Figs. 1-3 show a carbon media filter element 10 comprising a  
5 granular carbon layer 12, Fig. 3, sandwiched between first and second backing layers  
14 and 16, and forming a sheet 18. The sheet has a perimeter 19 with first and second  
axial ends 20 and 22, Fig. 1, distally oppositely axially spaced along an axis 24, and  
first and second lateral ends 26 and 28 distally oppositely laterally spaced along  
lateral direction 29 relative to axis 24 and extending between axial ends 20 and 22.  
10 Sheet 18 is pleated along axially extending bend lines 30, 31 to provide a plurality of  
pleats 32 extending axially between axial ends 20 and 22. A border member 34 is  
composed of urethane and provides a combined structural frame and seal extending  
along perimeter 19 along ends 20, 26, 22, 28, and provides both the support frame for  
the carbon filter media and a seal along the ends of sheet 18 retaining carbon granules  
15 between backing layers 14 and 16 and preventing escape of carbon granules out of the  
ends.

[00014] Pleats 32 have a pleat height 36, Figs. 3, 9, extending between bend  
lines 30 and 31 along a height direction 38 normal to axial direction 24 and normal to  
lateral direction 29. Border member 34 has a height 40, Fig. 9, extending along  
20 height direction 38 and at least as great as the height 36 of pleats 32 and covering and  
encapsulating axial ends 20 and 22 including carbon layer 12 and backing layers 14  
and 16. The height 40 of border member 34 is uniform along the entire perimeter 19  
of sheet 18 including at axial ends 20 and 22 and at lateral ends 26 and 28.

[00015] Border member 34 has a first section 42, Figs. 1-3, 8, 9, extending  
25 along height direction 38 and providing the noted support frame and the noted seal.  
Border member 34 has a second section 44 extending laterally outwardly from  
section 42 and resiliently compressible along height direction 38 for gasket sealing,  
e.g. within an intake duct or the like. Both of sections 42 and 44 are composed of  
urethane. The noted gasket sealing of section 44 along height direction 38 is parallel

to the flow direction 46 through the filter element. In one preferred embodiment, border member 34 has an L-shape provided by a first leg 42 extending along height direction 38, and a second leg 44 extending laterally outwardly from the first leg.

[00016] Manufacturing apparatus for making carbon media filter element 10 includes a mold base 50, Figs. 4, 6, 7, having a plurality of fins 52 extending axially between first and second axial ends 54 and 56, and having a height 56 extending upwardly along height direction 38 to upper peaks 58 defining axially extending bend lines 30 of sheet 18. Upper peaks 58 are laterally spaced by lower valleys 60 therebetween defining axially extending bend lines 31 of sheet 18. Base 50 has an inner perimeter 62 around fins 52. Inner perimeter 62 has first and second axial ends 64 and 66 distally oppositely axially spaced along axis 24, and has first and second lateral ends 68 and 70 distally oppositely laterally spaced along lateral direction 29 relative to axis 24. Lateral ends 68 and 70 of inner perimeter 62 extend axially between axial ends 64 and 66 of inner perimeter 62. Inner perimeter 62 provides a trough holding urethane therein.

[00017] A mold top 72, Figs. 5-7, has a plurality of fins 74 extending axially between first and second axial ends 76 and 78, and having a height 80 extending downwardly along height direction 38 to lower peaks 82 defining axially extending bend lines 31 of sheet 18. Lower peaks 82 are laterally spaced by upper valleys 84 therebetween defining axially extending bend lines 30 of sheet 18. Mold top 72 mates with mold base 50 with sheet 18 therebetween being pleated by respective fins 74 and 52 and with urethane in inner perimeter trough 62 along ends 64, 70, 66, 68 molding to the ends 22, 26, 20, 28 of sheet 18 along perimeter 19 to provide the noted combined structural frame and seal border member. In one embodiment, one of the mold base and mold top has one or more injection ports therethrough communicating with trough 62 for injecting urethane thereinto, for example injection ports 86 and 88 in mold base 50. In one embodiment, sheet 18 is pleated between the fins of the mold base and the fins of the mold top prior to introduction of urethane into trough 62. Sheet 18 may be pre-pleated prior to being placed in mold base 50 or in mold top 72.

As the urethane cures, it molds to the noted ends 22, 26, 20, 28 of sheet 18 along perimeter 19 to provide the noted combined structural frame and seal border member.

[00018] If desired, the ends of the sheet can be sealed by conventional techniques, e.g. hotmelt techniques, vibration welding, etc., prior to placing the sheet  
5 in mold base 50, to provide yet further sealing in combination with the noted urethane seal.

[00019] It is recognized that various equivalents, alternatives and modifications are possible within the scope of the appended claims.